RAK12004 Quick Start Guide

Prerequisite

What Do You Need?

Before going through each and every step on using RAK12004 WisBlock MQ2 module, make sure to prepare the necessary items listed below:

Hardware

- RAK12004 WisBlock MQ2 Gas Sensor Module
- Your choice of WisBlock Base with IO slot
- Your choice of WisBlock Core
- USB Cable
- Li-Ion/LiPo battery (required)
- Solar charger (optional)

Software

- Download and install Arduino IDE.
- To add the RAKwireless Core boards on your Arduino project, install the RAKwireless Arduino BSP. Follow the steps in the RAKwireless Arduino BSP.

Product Configuration

Hardware Setup

RAK12004 module is part of the WisBlock Sensor category and extends the WisBlock system with a gas sensor alert system. The RAK12004 connects to the WisBlock Base Board through the IO slot. The Figure 1 shows the assembly of a WisBlock Core highlighted in green and the module RAK12004 highlighted in red. Also, always secure the connection of the WisBlock module by using the compatible screws. For more information about RAK12004, refer to the Datasheet.

Figure 1: RAK12004 connection to WisBlock Base Board
Assembling and Disassembling of WisBlock Modules

Assembling

As shown in Figure 2, the location for the IO slot is properly marked by silkscreen. Follow carefully the procedure defined in WisBlock Base board assembly/disassembly instructions to attach a WisBlock module. Once attached, carefully fix the module with one or more pieces of M1.2 x 3 mm screws depending on the module.

Disassembling

The procedure in disassembling any type of WisBlock modules is the same.

1. First, remove the screws.

2. Once the screws are removed, check the silkscreen of the module to find the correct location where force can be applied.
3. Apply force to the module at the position of the connector, as shown in Figure 5, to detach the module from the baseboard.

![Figure 5: Applying even forces on the proper location of a WisBlock module](image)

**NOTE**

If you will connect other modules to the remaining WisBlock Base slots, check on the WisBlock Pin Mapper tool for possible conflicts. RAK12004 uses I2C and IO pins it can cause possible conflict especially on some IO modules.

After all this setup, you can now connect the battery and USB cable to start programming your WisBlock Core.

**WARNING**

- Batteries can cause harm if not handled properly.
- Only 3.7-4.2 V Rechargeable LiPo batteries are supported. It is highly recommended not to use other types of batteries with the system unless you know what you are doing.
- If a non-rechargeable battery is used, it has to be unplugged first before connecting the USB cable to the USB port of the board to configure the device. Not doing so might damage the battery or cause a fire.
- Only 5 V solar panels are supported. Do not use 12 V solar panels. It will destroy the charging unit and eventually other electronic parts.
- Make sure the battery wires match the polarity on the WisBlock Base board. Not all batteries have the same wiring.

### Software Configuration and Example

The RAK12004 has an electronic sensor used for sensing the concentration of gases in the air. It contains a sensing material whose resistance changes when it comes in contact with the gas. Concentrations of gas is measured using a voltage divider network present in the sensor. The output of the sensing element is connected to a 12-bit ADC (ADC121C021) which communicates through I2C to the application.

### Initial Test of the RAK12004WisBlock Module

1. Install the RAKwireless Arduino BSP for WisBlock by using the `package_rakwireless_index.json` board installation package. The WisBlock Core should now be available on the Arduino IDE.

2. You need to select first the WisBlock Core you have.

RAK4631 Board
Figure 6: Selecting RAK4631 as WisBlock Core

Figure 7: Selecting RAK11200 as WisBlock Core
RAK11310 Board

3. Install the RAKwireless MQx Library using Arduino Library Manager.

4. On the Arduino IDE, select Sketch -> Include Library -> Manage Libraries, as shown in Figure 9.

5. On the Library Manager text area, type RAKwireless MQx.

6. To finish the installation, click on the Install button, as shown in Figure 10.
7. Once the library is installed, open the `RAK12004_MQ2_Sampling` example.

8. On the Arduino IDE, select `File -> Examples -> RAKWireless MQx Libraries -> RAK12004_MQ2_Sampling`, as shown in Figure 11.

![Figure 11: Open RAK12004 MQ2 Sampling Sketch](image)

**NOTE**

If you experience any error in compiling the example sketch, check the updated code for the RAK12004 WisBlock MQ2 Gas Sensor Module that can be found on the [RAK12004 WisBlock Example Code Repository](#).

9. You can now select the right serial port and upload the code, as shown in Figure 12 and Figure 13.
To extend the use of the RAK-MQx library, check the link [RAK-MQx Library methods](#).

**Build RAK12004 Example on PlatformIO IDE (optional)**

![Figure 12: Selecting the correct Serial Port](image1.png)

![Figure 13: Uploading the RAK12004 example code on RAK4631](image2.png)

**NOTE:**

This procedure was tested only on Windows 10 and Ubuntu.

1. Install the original PlatformIO platform, as shown in [PlatformIO First Install](#) section.

   - For WisBlock Core RAK4631, install [Nordic nRF52](#) platform.
   - For WisBlock Core RAK11200, install [Espressif 32](#) platform.
   - For WisBlock Core RAK11310, install [Raspberry Pi RP2040](#) platform.

2. Open a project example that uses the new installed platform.
3. Launch **Visual Studio Code** and select **PlatformIO PIO Home**.

4. On **PIO Home**, click on **Project Examples**.

5. Choose **arduino-blink** project, then click on **Import** button.

![Figure 14: Import arduino-blink project](image)

6. Click the **Yes** button on the trust window.

![Figure 15: PlatformIO trust authors](image)

7. Build the project and ignore warnings and errors.

8. Download and install the **RAK Patch script**.

9. Unzip the contents of **RAK_PATCH.zip** into the folder **RAK_PATCH** in your PlatformIO installation folder.

The table below shows the PlatformIO installation directory for each operating system:

<table>
<thead>
<tr>
<th>PlatformIO path on different OS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Windows 10</strong></td>
<td><code>%UserProfile%\.platformio\</code></td>
</tr>
<tr>
<td><strong>Linux</strong></td>
<td><code>~/.platformio/</code></td>
</tr>
<tr>
<td><strong>MacOS</strong></td>
<td><code>/Users/{Your_User_id}/.platformio/</code></td>
</tr>
</tbody>
</table>

**Figure 16** shows the PlatformIO installation directory on Windows 10.
10. Open a command prompt in `%UserProfile%.platformio\RAK_PATCH` folder and execute `python ./rak_patch.py`.

11. Import the RAK12004 Arduino Project to PlatformIO.

12. Open PlatformIO PIO Home and select Import Arduino Project, as shown in Figure 18.

**WARNING**

In case of any platform update on PlatformIO, the RAK_PATH script must be executed again after the platform update.
13. Select your preferred WisBlock Core and check "Use Libraries installed by the Arduino IDE" option, as shown in Figure 19.

14. Then choose the directory of the original RAK12004 Arduino Project.

15. To finish the import, click on the Import button, as shown in Figure 20.
16. Build the imported project on the PlatformIO.

Now, you can build the project by clicking on the highlighted icon, as shown in Figure 21.

17. Upload the imported project on the PlatformIO.

18. To upload the project on the target board, click on the highlighted icon, as shown in Figure 22.
Figure 22: Upload Arduino imported project
RAK12004 WisBlock MQ2 Gas Sensor Module Datasheet

Overview

Description

The RAK12004 is a gas sensor module, part of the RAKWireless WisBlock Sensor series. The sensor used is the MQ-2 from Zhengzhou Winsen Electronics.

Features

- MQ-2 gas sensor
- Sensitivity to LPG, butane, propane, methane, alcohol, hydrogen, smoke, and other flammable steam
- I2C Interface
- Alert function
- Detection Range: 300~10000 ppm (flammable gas)
- 3.3 V Power Supply
- Chipset: Winsen MQ-2
- Module size: 25 x 35 mm

Specifications

Overview

Mounting

The RAK12004 WisBlock MQ2 Gas Sensor Module can be mounted to the IO slot of the WisBlock Base board. Figure 1 shows the mounting mechanism of the RAK12005 on a WisBlock Base module.

![Figure 1: RAK12004 WisBlock MQ2 Gas Sensor Mounting](image)

Hardware

The hardware specification is categorized into five (5) parts. It shows the chipset of the module and discusses the pinouts and their corresponding functions and diagrams. It also covers the electrical and mechanical characteristics that include the tabular data of the functionalities and standard values of the RAK12004 WisBlock MQ2 Gas Sensor Module.

Chipset

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winsen</td>
<td>MQ-2</td>
</tr>
</tbody>
</table>
Pin Definition

The RAK12004 WisBlock MQ2 Gas Sensor Module comprises a standard 40-pin WisConnector. The WisConnector allows the RAK12004 module to mounted to a WisBlock Base Board. The pin order of the connector and the pinout definition is shown in Figure 2.

NOTE:

I2C related pin, ALERT, EN, VBAT, 3V3, and GND are connected to 40-pin WisConnector.

Figure 2: RAK12004 WisBlock MQ2 Gas Sensor Pinout

Electrical Characteristics

Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBAT</td>
<td>Supply Voltage</td>
<td>2.8</td>
<td>-</td>
<td>4.2</td>
<td>V</td>
</tr>
<tr>
<td>VCCIO</td>
<td>Digital IO Power Supply</td>
<td>-</td>
<td>3.3</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>VCC</td>
<td>ADC to I2C Chip Power Supply</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>V</td>
</tr>
</tbody>
</table>

Mechanical Characteristics

Board Dimensions

Figure 3 shows the dimensions and the mechanic drawing of the RAK12004 module.
WisConnector PCB Layout

Schematic Diagram

Power Supply Circuit

Figure 5 shows RAK12004 step-up power supply circuit.

- **VBAT** Battery voltage (max voltage is 4.2 V)
- **EN** Power enable pin (active high). This pin is connected to IO6 of WisBlock Core.
Gas Detector Circuit

Figure 6 shows the gas detector circuit.

- **U2** Gas sensor

  The heater voltage requires a 5 V supply which is provided by the 5 V step-up converter. This is needed to achieve the standard working temperature of the sensor. The pins 1 and 3 voltage (5 V) supply the detect voltage to load resistance R12. The AOUT pin is the voltage of load resistance R12 which represents the reading of the U2 sensor.

- **U3** ADC121C021 12-Bit Analog-to-Digital converter with alert function. The U3 power supply is 5 V.

Voltage Level Shifter Circuit

The 40-pin WisConnector voltage has a voltage level of 3.3 V while U2 and U3 have 5 V. To interface the different voltage level between 40-pin WisConnector and gas sensor, the RAK12004 has a built-in voltage level shifter circuit.
I2C Address

The I2C address of the Analog-to-Digital converter chip of RAK12004 can be configured via resistor jumpers as shown in Figure 8.

J2 Connector Pinout

RAK12004 has an additional connector to provide an extra interface to the module. The pinout of J2 connector is shown in Figure 9.
Figure 10 shows 40-pin WisConnector pinout.

- **VBAT** battery voltage
- **I2C1_SDA** and **I2C1_SCL** are I2C related pins
- **EN** is power chip enable pin
- **ALERT** is analog-to-digital converter alert pin

![WisConnector Pinout Diagram](image-url)